

Message

From: Dan Pope [DPope@css-inc.com]
Sent: 9/15/2017 6:11:40 PM
To: Davis, Eva [Davis.Eva@epa.gov]
Subject: RE: 2017-9-12 - WAFB - Praxis evaluation of Amec 8-16-2017 review – Praxis Time of Remediation TOR memo 5-30-2017 - EBR ST012 - FPU18-045 - epa

Not that we need more, just that there will be reason to name more.

From: Davis, Eva [mailto:Davis.Eva@epa.gov]
Sent: Friday, September 15, 2017 1:11 PM
To: Dan Pope
Subject: RE: 2017-9-12 - WAFB - Praxis evaluation of Amec 8-16-2017 review – Praxis Time of Remediation TOR memo 5-30-2017 - EBR ST012 - FPU18-045 - epa

Does he really think we need more superfund sites?

From: Dan Pope [mailto:DPope@css-inc.com]
Sent: Friday, September 15, 2017 1:06 PM
To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Davis, Eva <Davis.Eva@epa.gov>; 'Cosler, Doug' <Doug.Cosler@TechLawInc.com>; Bo Stewart <Bo@Praxis-Enviro.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
Cc: Henning, Loren <Henning.Loren@epa.gov>; Fairbanks, Brianna <Fairbanks.Brianna@epa.gov>
Subject: RE: 2017-9-12 - WAFB - Praxis evaluation of Amec 8-16-2017 review – Praxis Time of Remediation TOR memo 5-30-2017 - EBR ST012 - FPU18-045 - epa

I don't think anyone really knows what the in-situ effects could be. I do know that we had a very famous microbiologist and remediation expert do a seminar at the lab yesterday, and he urged us to jump on the PFA bandwagon. Said he expected it to be the next Superfund site creator, because they have been shown to be human and environmental health hazards, but nobody is really doing anything about them. We'll probably drink them for a few more years, till we figure out how they're killing us.

From: d'Almeida, Carolyn K. [mailto:dAlmeida.Carolyn@epa.gov]
Sent: Friday, September 15, 2017 12:59 PM
To: Dan Pope; Davis, Eva; 'Cosler, Doug'; Bo Stewart; Wayne Miller (Miller.Wayne@azdeq.gov)
Cc: Henning, Loren; Fairbanks, Brianna
Subject: RE: 2017-9-12 - WAFB - Praxis evaluation of Amec 8-16-2017 review – Praxis Time of Remediation TOR memo 5-30-2017 - EBR ST012 - FPU18-045 - epa

That's another factor that should be considered in the CSM but isn't due to the piecemeal approach. what impact if any would PFAS have on microbial populations?

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"Because a waste is a terrible thing to mind..."

From: Dan Pope [mailto:DPope@css-inc.com]
Sent: Friday, September 15, 2017 10:53 AM
To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Davis, Eva <Davis.Eva@epa.gov>; 'Cosler, Doug' <Doug.Cosler@TechLawInc.com>; Bo Stewart <Bo@Praxis-Enviro.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
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The foams will have a surfactant(s) in them -- the perfluorinated compounds themselves are surfactants, and there might be other surfactants added to foams.

“Fluorosurfactants (also fluorinated surfactants, perfluorinated alkylated substances or PFASs) are synthetic organofluorine chemical compounds that have multiple fluorine atoms. They can be polyfluorinated or fluorocarbon-based (perfluorinated). As surfactants, they are more effective at lowering the surface tension of water than comparable hydrocarbon surfactants. They have a fluorinated "tail" and a hydrophilic "head." Some human-made fluorosurfactants, such as PFOS and PFOA, are persistent organic pollutants and are detected in humans and wildlife.”

<https://en.wikipedia.org/wiki/Fluorosurfactant>

I'm not sure how much of the foam it would take to make any difference in the LNAPL in terms of solubility or mobility. Probably it would take a huge amount, because there's a huge amount of LNAPL out there.

From: d'Almeida, Carolyn K. [mailto:dAlmeida.Carolyn@epa.gov]
Sent: Friday, September 15, 2017 12:45 PM
To: Dan Pope; Davis, Eva; 'Cosler, Doug'; Bo Stewart; Wayne Miller (Miller.Wayne@azdeq.gov)
Cc: Henning, Loren; Fairbanks, Brianna
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We know they did dump some PFAS – fire fighting foam out there a few times and that's probably mixed in. Is that a surfactant?

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“Because a waste is a terrible thing to mind...”

From: Dan Pope [mailto:DPope@css-inc.com]
Sent: Friday, September 15, 2017 10:39 AM
To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Davis, Eva <Davis.Eva@epa.gov>; 'Cosler, Doug' <Doug.Cosler@TechLawInc.com>; Bo Stewart <Bo@Praxis-Enviro.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
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I'm not sure about sulfate breaking up and dispersing the LNAPL. Salts of various kinds can help break up water/oil emulsions – I've used that in the lab many times – but I'm not up to date on breaking up NAPLs with sulfate. Of course there are many sulfate compounds that are surfactants. The sulfate compounds have the sulfate end as a polar part of the compound, and a long hydrocarbon-type (or similar) tail that is the nonpolar part of the compound, making the compound work as a surfactant. But such compounds are not the same as just the lone sulfate anion. Do we have a surfactant expert on the team?

As far as massive doses of sulfate killing the bugs, that's a good thing near the wells, to keep the wells from fouling. But I doubt there will be a widespread effect of the sulfate killing all the bugs. Besides, they have toned down the high concentrations of sulfate proposed a bit, and also there's no way they are going to get such uniform distribution of sulfate that they could end up with super-high concentrations throughout a major part of the subsurface. They're largely depending on injection/extraction to get high concentration "streaks" of sulfate across the site, and then hoping for natural advection to dilute and move the sulfate streaks across the site downgradient.

From: d'Almeida, Carolyn K. [<mailto:dAlmeida.Carolyn@epa.gov>]
Sent: Friday, September 15, 2017 12:23 PM
To: Dan Pope; Davis, Eva; 'Cosler, Doug'; Bo Stewart; Wayne Miller (Miller.Wayne@azdeq.gov)
Cc: Henning, Loren; Fairbanks, Brianna
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Question is, will massive doses of sulfate itself break up and disperse the LNAPL as a surfactant? That seems to be what they are counting on. If it does LNAPL will also become more mobile. Will rate of degradation exceed rate of off site migration? Massive doses of sulfate all at once may also kill off the bugs and impede degradation

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"Because a waste is a terrible thing to mind..."

From: Dan Pope [<mailto:DPope@css-inc.com>]
Sent: Friday, September 15, 2017 10:14 AM
To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Davis, Eva <Davis.Eva@epa.gov>; 'Cosler, Doug' <Doug.Cosler@TechLawInc.com>; Bo Stewart <Bo@Praxis-Enviro.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
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I would guess that the wells/surrounding aquifer got severely fouled pretty quickly, too. The bugs are working all the time, and they don't care what the remedial goals are....

☺

From: d'Almeida, Carolyn K. [<mailto:dAlmeida.Carolyn@epa.gov>]
Sent: Friday, September 15, 2017 12:09 PM
To: Dan Pope; Davis, Eva; 'Cosler, Doug'; Bo Stewart; Wayne Miller (Miller.Wayne@azdeq.gov)
Cc: Henning, Loren; Fairbanks, Brianna

Subject: RE: 2017-9-12 - WAFB - Praxis evaluation of Amec 8-16-2017 review – Praxis Time of Remediation TOR memo 5-30-2017 - EBR ST012 - FPU18-045 - epa

Dan

The reason pump and treat did not work 20 years ago is because the water table was much lower than it is now, and probably the unit was not as transmissive as the CZ where the water table is now. 2 12 inch horizontal wells were installed with screens just below the water table in the vicinity of the subsequent TEE pilot test. The belief at the time was that the LNAPL would be floating on the water table and that they could just skim it off. As it was the 2 12 inch wells could not sustain yield, and the P&T attempt was abandoned.

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From: Dan Pope [mailto:DPope@css-inc.com]
Sent: Friday, September 15, 2017 7:15 AM
To: Davis, Eva <Davis.Eva@epa.gov>; d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; 'Cosler, Doug' <Doug.Cosler@TechLawInc.com>; Bo Stewart <Bo@Praxis-Enviro.com>; Wayne Miller (Miller.Wayne@azdeq.gov) <Miller.Wayne@azdeq.gov>
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The Praxis evaluation statements (as far as I understand them, anyway) are a good reiteration, with more technical detail, of course, of many of the things we've been saying all along.

That is, if the LNAPL at the site were uniformly distributed (little globules of LNAPL with lots of surface area per unit mass of LNAPL, and lots of space around each globule of LNAPL for groundwater to flow all around each globule), as the AMEC approach/modeling assumes to greater or lesser degrees, then:

- 1) sulfate/nutrients could be readily delivered all around each LNAPL globule so that sulfate/nutrients are not limiting factors for biodegradation, and
- 2) COCs would readily move out of the LNAPL to groundwater (and therefore be available for biodegradation by the groundwater-dwelling microbes), because the diffusion path of the COCs from within the LNAPL globule to groundwater is short.

However, if that assumed distribution of LNAPL were correct, then P&T would work well, because P&T is doing the same thing as EBR (that is, carrying away the COCs for extraction as soon as the COCs move from the LNAPL into groundwater, and of course creating/maintaining a high gradient of COC concentration from LNAPL to groundwater).

However, P&T did not work, as acknowledged by all. Also, I suspect (I haven't read all the old site documents) that the rationale given for why P&T didn't work and should be abandoned is essentially that the small-globule-well-distributed idea of LNAPL distribution is not actually the case at the site. And if the small-globule-well-distributed idea of LNAPL distribution is not actually the case at the site, then the AMEC TOR predictions are likely to be highly optimistic.

Note also that Praxis reiterates the point that the sampling locations and statistical treatment of performance monitoring data is paramount (item 3). There's a big difference between:

1. remediating until the overall site groundwater COC concentration mean across all sampling locations is MCL or below, or
2. remediating until the groundwater COC concentration at each and every sampling location is MCL or below.

Note that Praxis points out the change in limiting factors, once sulfate is well-distributed.

That is, if there's plenty of sulfate and nutrients all around the little globules of LNAPL, then the mass transfer of COCs from the LNAPL to groundwater (so as to be available for degradation by the groundwater-dwelling microorganisms) is probably the limiting factor for degradation and remediation.

Obviously then the assumptions about LNAPL distribution, COC gradients from LNAPL to groundwater, COC diffusion path lengths in the LNAPL, etc. become the major factors affecting the predictions of TOR. But it's exactly those assumptions that are major factors in the differences between our TOR predictions and AMEC's TOR predictions.

That is, AMEC appears to hold (at least implicitly) that the small-globule-well-distributed idea of LNAPL distribution at the site is generally true, whereas we hold that the small-globule-well-distributed idea of LNAPL distribution is not generally true, or at least not true enough to allow EBR to proceed as successfully at AMEC claims.

We hold that significant amounts of the LNAPL at the site are distributed in large masses, with some perhaps in low permeability zones, so that:

1. effective distribution of sulfate/nutrients to the large masses is problematic, and
2. transfer of COCs from the large masses of LNAPL to groundwater is problematic because the diffusion path length from the interior of the LNAPL masses to groundwater is long.

Praxis writes many other useful things in their evaluation, but the ones I summarized above are ones that stand out for me.

From: d'Almeida, Carolyn K.

Sent: Wednesday, September 13, 2017 5:27 PM

To: Davis, Eva <Davis.Eva@epa.gov>; 'Dan Pope' <DPope@css-inc.com>; 'Cosler, Doug' <Doug.Cosler@TechLawInc.com>

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Fyi – Bo's comments on the RTCs to the TOR memo

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"Because a waste is a terrible thing to mind..."

From: Wayne Miller [<mailto:Miller.Wayne@azdeq.gov>]

Sent: Tuesday, September 12, 2017 4:58 PM

To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>

Cc: steve <steve@uxopro.com>

Subject: 2017-9-12 - WAFB - Praxis evaluation of Amec 8-16-2017 review – Praxis Time of Remediation TOR memo 5-30-2017 - EBR ST012 - FPU18-045 - epa

For your use -

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